COLSF 8.4 V1

LANDAU ASSOCIATES, INC.
Geoenvironmental Engineering and Technologies

TECHNICAL MEMORANDUM
COLBERT LANDFILL RD/RA PROJECT

Date: November 10, 1989

RE: Well Verification Survey Results

By: Brian Butler

A well verification survey (Survey) was conducted to assist in selecting initial South System monitoring well locations for Phase I of the Colbert Landfill RD/RA project, and to provide additional information on ground water flow in the Lower Aquifer to the southeast of the landfill. Data were collected between August 28 and October 4, 1989 from domestic wells (and two monitoring wells) located to the south of the landfill and screened in the Upper Sand/Gravel Aquifer (Upper Aquifer), and from domestic wells located to the southeast of the landfill and screened in the Lower Aquifer. Activities conducted during the Survey included:

- Measurement of the depth of 9 domestic wells. This task required removal and installation of pumps for 7 wells;
- Installation of access ports (for water elevation measurements) in 2 wells;
- Establishment of well head reference elevations by survey (for water elevation measurements) for 13 wells; and
- Measurement of ground water elevations from 17 wells completed in the Upper Aquifer (including monitoring wells CD-3 and CD-6) and 5 wells completed in the Lower Aquifer.

Some of the wells included in the Survey differed from those initially selected (and described in the Phase I Monitoring Well Construction Plan) because of difficulties encountered in obtaining

access from the property owner. Additionally, physical access difficulties made pump removal and the collection of water levels impractical at some locations. Access for all Survey activities was denied by the owners of two wells ((b) (6)). Permission for pump removal was denied by the owners of three wells ((b) (6)). Physical access difficulties made pump removal impractical for 3 wells ((b) (6)). Access ports were installed in two wells ((b) (6)) to permit water level measurement. The (b) (6) (west) well was added to the Survey to replace the (b) (6) well. Monitoring wells CD-3 (middle) and CD-6 (upper) were added to provide Upper Aquifer water elevations to the north of the Survey area. The wells included in the Survey are shown on Figure 1, as are the wells for which access was denied by the owner.

Ground surface elevations, water level reference elevations, well depth, ground water elevations, aquifer designation (Upper or Lower), and apparent aquifer thickness are presented in Table 1 for wells included in the Study. Apparent aquifer thickness is the difference between the well depth and depth to water, and is only reported for Upper Aquifer wells where well depth was verified by Landau Associates, or data were available from the Remedial Investigation. Apparent Upper Aquifer thickness varied from 9ft to 18ft; it should be recognized that the apparent thickness may represent a maximum value because most of these wells have probably been constructed with a (tail pipe) sump that extends into the underlying Lacustrine Aquitard. Based on these data Landau Associates anticipates an Upper Aquifer thickness of between 7ft and 15ft near the leading edge of the plume.

A water elevation contour map was developed based on the October 4, 1989 water levels and is shown on Figure 2. These contours indicate a southeasterly direction of flow at the anticipated leading edge of the plume (near the (b) (6) well).

Based on these data, available ground water chemical data, and property access considerations, proposed locations for the initial Phase I - South System monitoring wells have been selected and are shown on Figure 2.

The measurements collected from the Lower Aquifer wells to the southeast of the landfill indicate an apparent (local) southeasterly flow direction (from the (b) (6) and (b) (6) wells to the (b) well). However, these data may be misleading due to complex hydrogeologic conditions, variable well construction details, and the limited amount of data available. Ground water flow in this area will be more thoroughly evaluated once the Phase I - East monitoring wells have been constructed. It should also be noted that the (b) (6) well has about a 1ft saturated thickness and is about 60ft shallower than reported by the owner; it appears the well may have caved in, and water elevations collected from this location may not be representative of either Upper or Lower Aquifer conditions.

LAB/kmo
124-01.24

TABLE 1. WELL VERIFICATION SURVEY RESULTS

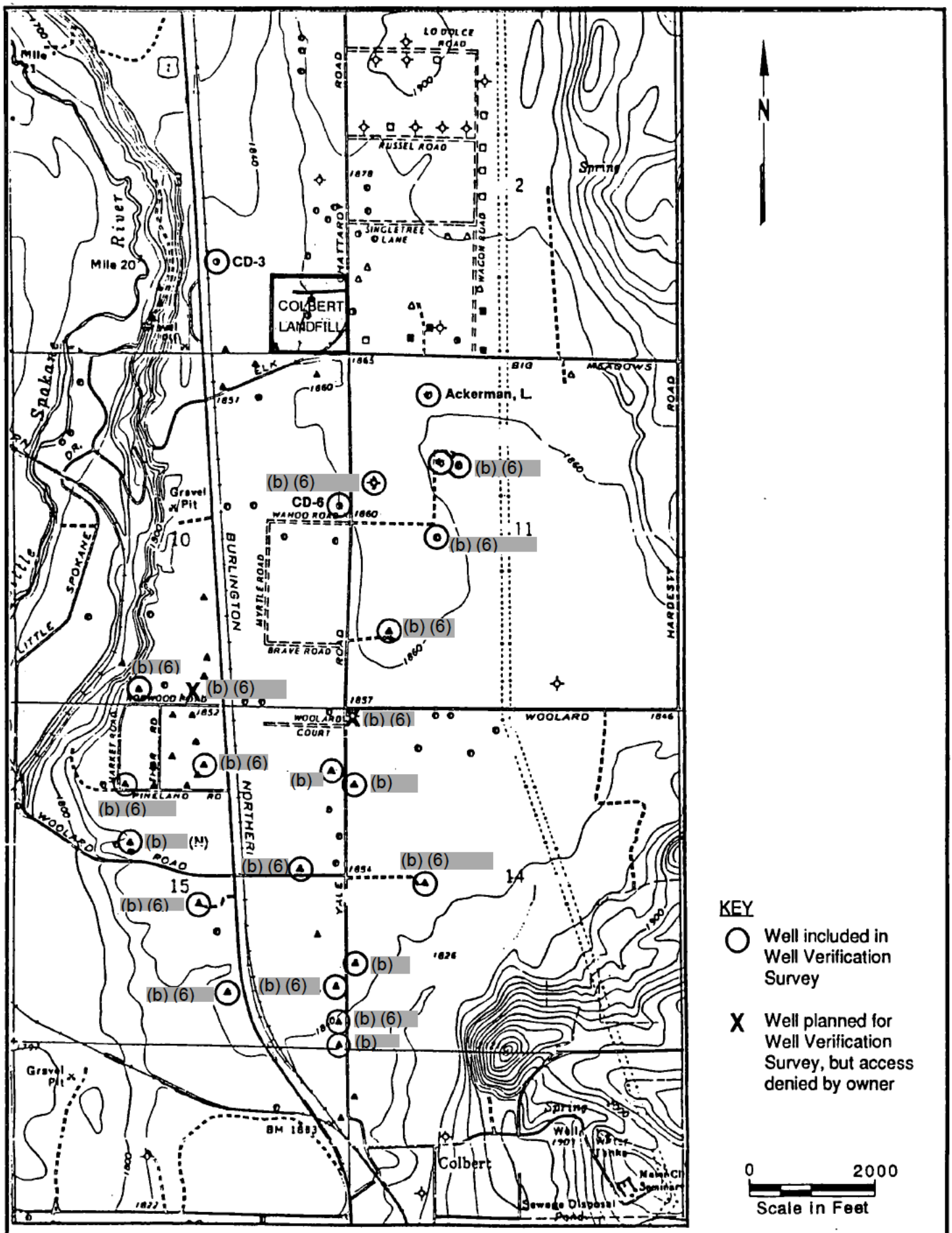
OWNER/ WELL	GROUND ELEVATION (1)	WATER LEVEL REFERENCE ELEVATION (1)	DEPTH OF WELL (FT) (2)	GROUND WATER ELEVATION 8/28/89 TO 9/13/89	GROUND WATER ELEVATION 10/4/89	DESIGNATED AQUIFER (3)	APPARENT AQUIFER THICKNESS (FT) (4)	COMMENTS
(b) (6)	1859.4	1854.50 1854.30 (5)	181.8 (6)	1683.07	--------	LOWER	-------	
(b) (6)	1860.0	1861.83	101.5 (6)	1761.81	--------	LOWER	-------	- OWNER REPORTED 165 FT DRILLED DEPTH (WELL CAVED) - WATER LEVEL 1 FT ABOVE BOTTOM OF WELL (ANOMALOUS) - NO PUMP IN WELL
(b) (6)	1860.9	1855.50	520 (8)	1689.00	--------	LOWER	-------	- NO PUMP IN WELL
(b) (6)	1856.2 (5)	1851.75 (5)	110 (9)	--------	1759.10	UPPER	-------	- OWNER DENIED ACCESS FRO PUMP REMOVAL - ACCESS PORT INSTALLED
(b) (6)	1825.8	1820.01	100 (9)	1756.99	1757.17	UPPER	-------	
CD-3	1842.0	1845.13	90 (9)	--------	1773.49	UPPER	18	
CD-6	1859.3	1862.12	100 (9)	--------	1771.43	UPPER	9	
(b) (6)	1845.5 (5)	1839.15 (5)	97.1 (6)	1757.43	1757.44	UPPER	12	
(b)	1856.60	1856.88 1856.95 (5)	112.0 (6)	1760.19	1760.27	UPPER	15	
(b)	1856.3	1849.48	--------	--------	--------	--------	-------	- ACCESS DENIED FOR ALL WELL VERIFICATION - ACTIVITIES
(b)	1852.4 (5)	1844.62 (5)	106 (9)	1758.57	1758.80	UPPER	-------	- WELL CONFIGURATION PREVENTED PUMP REMOVAL
(b)	1823.1	1824.30	125 (9)	1758.04	1758.06	UPPER	-------	
(b) (6) (WEST)	1844.1 (5)	1838.67 (5)	97 (9)	1763.15	1763.43	UPPER	-------	- ADDED TO STUDY TO REPLACE (b) (6) WELL
(b) (NORTH)	1845.8 (5)	1840.58 (5)	94.0 (6)	1762.68	1762.69	UPPER	16	

TABLE 1. WELL VERIFICATION SURVEY RESULTS (CONT.)

OWNER/ WELL	GROUND ELEVATION (1)	WATER LEVEL REFERENCE ELEVATION (1)	DEPTH OF WELL (FT) (2)	GROUNDWATER ELEVATION 8/28/89 TO 9/13/89	GROUND WATER ELEVATION 10/4/89	DESIGNATED AQUIFER (3)	APPEARENT AQUIFER THICKNESS (FT) (4)	COMMENTS
(b)	1853.7	1855.33	--------	1760.58	1761.05	UPPER	-------	- WELL CONFIGURATION PREVENTED PUMP REMOVAL
(b) (6)	1844.2	1839.13	97 (9)	1759.23	1760.03	UPPER	-------	- OWNER HAD RECENTLY REMOVED PUMP AND MEASURED WELL DEPTH
(b)	1857.9 (5)	1858.61 (5)	99 (9)	1767.59	1767.63	UPPER	-------	- OWNER DENIED ACCESS FOR PUMP REMOVAL
(b)	1849.6 (5)	--------	101 (9)	--------	--------	UPPER	-------	- WELL CONFIGURATION PREVENTED PUMP REMOVAL - ACCESS PORT INSTALLED 10/19/89
(b) (6) (EAST)	1858.5	1859.92	190.8 (6)	1729.86	-------	LOWER	-------	- WELL REPORTEDLY BACKFILLED FROM 300 FT BGS
(b) (6) (WEST)	1858.9	1853.07	185.0 (6)	1691.70	-------	LOWER	-------	
(b)	1849.0	1844.66	100 (9)	1761.37	1761.38	UPPER	-------	
(b)	1854.20	1854.60	108.2 (6)	1760.81	1761.01	UPPER	14	- NO PUMP IN WELL
(b) (6)	1845.97	1841.13	--------	1766.17	--------	UPPER	-------	- OWNER COULD NOT BE CONTACTED FOR PERMISSION - TO COLLECT 10/4/89 WATER LEVEL
(b) (6)	--------	--------	--------	--------	--------	--------	-------	- ACCESS DENIED FOR ALL WELL VERIFICATION - ACTIVITIES

FOOTNOTES:

1. Feet above mean sea level. Spokane County datum. Elevation surveyed by Taylor Engineering, Inc., September 1989, unless indicated otherwise.
2. Depth in feet below water level reference elevation.
3. Upper=Upper Sand/Gravel Aquifer
   Lower=Lower Sand/Gravel Aquifer, and all underlying aquifers.
4. Appearent aquifer thickness is the difference between the depth to to water and the well depth, and is only reported for Upper Aquifer wells that have had well depth measurements collected by Landau Associates, Inc., or reported in Remedial Investigation.
5. Elevation from the Remedial Investigation.
6. Depth measured by Landau Associates, Inc.
7. ------- = no data available.
8. Depth provided by owner. Landau Associates, Inc. confirmed that the well exceeded 500 ft in depth, but did not measure the complete depth.
9. Depth provided by owner, obtained from the Colbert Landfill ground water sampling committee, or reported in Remedial Investigation.

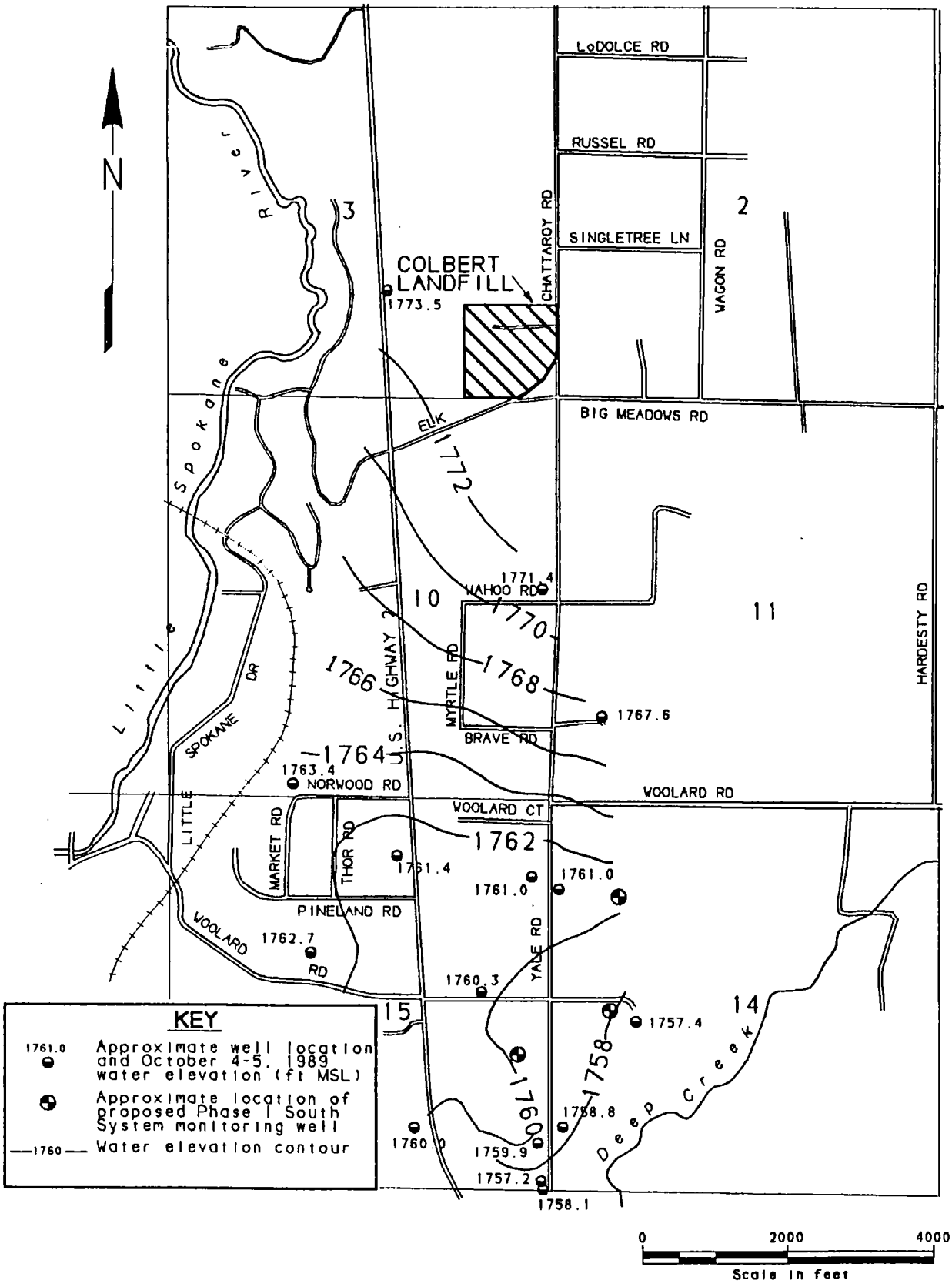


LANDAU ASSOCIATES, INC.

Well Verification Survey Site Plan

Figure 1

124-01.24 Colbert Landfill RD/RA/Upper Aquifer Verification/Survey Tech Memo 10-27-89



124-01.24 Colbert Landfill RD/RA/Upper Aquifer Verification Study 11-3-89

LANDAU ASSOCIATES, INC.

Upper Aquifer Ground Water Elevations and Proposed South System Monitoring Well Locations

Figure 2